FOSSIL ARTHROPODS FROM BRITISH COLUMBIA

By W. Dwight Pierce

1. INTRODUCTION

The present series of studies is designed to present the findings of Walter MacKay Draycot, of Lynn Creek, British Columbia. He has sent to the writer for study several collections of pieces of fossil interglacial lignite (Pleistocene), containing insect remains from two localities.

The first locality was originally found by Rev. Mr. Robert Connell years ago on the shore of Cordova Bay, Vancouver Island, and the first insects from the deposit were described by T. D. A. Cockerell in Canadian Entomologist 59:303-304, as *Donacia connelli* Cockerell, and *D. pompatica* Scudder.

Mr. Draycot visited this site with Mr. Connell in 1945.

Cockerell described the material as a "black lignite from the south end of Cordova Bay, Victoria. The deposit is overlain by 180 feet of clay, sand and gravel called the Cordova sands and gravels and the Maywood clays, the latter the older and both are known to be interglacial. Just above the lignite is a bed of marine shells, and below are finely stratified clays. The lignite contains pieces of wood, seeds, and other plant remains."

Cockerell discussed only the *Donacia* material but said that there were "also a few small black elytra which I have not attempted to determine."

Mr. Draycot wrote October 23, 1946 that to get to the deposit he had to take from Victoria, "the hourly-service bus to a point a mile from Cordova Bay deposits, climb down a steep bank, 180 feet high—and hope for the tide being out when I arrived." His description of the geology is to be found in the following paper.

The second locality is on the Mainland on the banks of Lynn Creek, near the post office of that name, outside of Vancouver; and the geology of the deposits is reported on by Mr. Draycot in the second article of this series.

The material he has sent is very interesting, and will have to be reported on in sections. The botanical material will be studied by paleobotanists. Most of the insect fragments are beetle elytra, some of them so perfect that, by careful work under a binocular microscope, they can be completely freed and mounted in a glass cell for study on both surfaces. Others are badly crushed and must be mounted in cells in the matrix. This crushing is particularly

true of the Donacia material, which still retains its beautiful blue or green lustre.

In all there are 7 insect specimens from Cordova Bay, and 103 specimens from Lynn Creek. Of these some are of course unrecognizable, but there is part of an *Elaphrus* elytron, an elytral fragment of a *Phellopsis,* possibly *porcata* Leconte, many *Donacia,* and several species of small beetles, Lepidopterous pupal remains, and the beautiful psyllid wing described in Article 3. Twelve or more perfect elytra have been separated, and one head.

It is not always easy to locate the classification of elytra, and some of these may need to wait until the study of the California tar deposits gives the cues.

2. PLEISTOCENE FOSSIL BEETLE AND VEGETAL REMAINS IN INTERGLACIAL DEPOSITS; A SUMMARY REPORT

By Walter MacKay Draycot

The occurrence of vegetal remains belonging to the Interglacial Period of the Ice Age is recorded mainly along the coastal region of British Columbia. The exposures are meagre; mostly accumulated drift, and gradually disappearing through the effect of river and marine erosional action. In the Greater Vancouver area there are the Lynn Creek Series (situated five miles north of Vancouver City), a shoreline deposit at Point Grey (Vancouver west), and the Cordova Bay Series of Interglacial deposits on the southeastern shoreline of Vancouver Island.

SUMMARY OF PLEISTOCENE

Glaciation of Southern British Columbia and the State of Washington, U. S. A. occurred in the form of two major epochs, the first known as the Admiralty epoch and the second, and last, the Vashon. Both epochs were southern extensions of the great Cordilleran ice sheet that spread over northern and central British Columbia. The names Admiralty and Vashon denote an Inlet and an Island, respectively, in the State of Washington where the two separate glaciation deposits were first noticed by American geologists.

Though retreats and re-advances occurred during the two epochs these phases of minor interglacial periods are insignificant, inasmuch as their duration was too brief to permit vegetation, other than grasses and sedges, to flourish.

Advent of the Admiralty Glacier: At the time the Admiralty ice-sheet was forming the land was much lower, relative to sea-level, than now. As the crystallized mass transformed from névé to glacier it culminated in an estimated height of 5,000 feet. This ponderous weight of solid ice, besides depressing the land, had the effect of pulverizing the sub-ice rock material over which it steadily flowed, mainly southwesterly, far into the state of Washington, Puget Sound and the Strait of Georgia. Infra-glacial rock fragments, composed of small boulders, pebbles and finer detritus, the result of earlier avalanches or snowslides, were carried hundreds of miles from the source of origin.

Duration of Admiralty Ice: Compilation in number of years for the existence of either this first epoch or the last one must ever remain approximate. It can not be definitely known what length of time climatic conditions remained stationary during maximum frigidity.

Retreat of the First Ice Epoch: As many thousands of years (kalandar) had elapsed since the advent of the ice so thousands more were required to melt the gigantic ice mass in Washington State and British Columbia's southern area. As the melt proceeded the run-off from above and below the ice formed great glacial lakes. Far into these lakes spread the fine silts, known as blue clay, and, nearer the ice front, the fine to course sands pebbles and small boulders. Toward the close of the Admiralty ice epoch the great glacial lakes dwindled in size. Marine waters entered, into which rivers of mostly new channels debouched.

INTERGLACIAL PERIOD IN LYNN VALLEY

Through the visitation of colossal ice conditions the terrain of superficial deposits assumed a barren aspect. A semi-frigid climate obtained for a considerable span of time before the ice had receded far enough into the mountain recesses to permit the hardiest of the lower order of plant life to germinate its seed. Though this was especially the case in the north Burrard region it was not so with the more open terrain of the Cordova Bay area on Vancouver Island, where favorable climatic conditions, close proximity to marine water and far removed from the chilled air of mountain glaciers, induced prior vegetal growth. In some respects the Point Grey shoreline vegetation, somewhat removed from the retreated glacier, enjoyed a similar climate.

Duration of Interglacial: Judging by the stratigraphy of the Interglacial deposits there is evidence of a vast period of time; necessary to deposit the thousands of alternating beds of silt, clay, sand, gravel pebbles and small boulders. A fertile floor for inducement of plant growth.

Vegetal Growth: Continuity of plant life was established in the Great Interglacial Period only during the second half of its existence, although there is evidence of grass growth during a brief withdrawal of the Admiralty glacier, indicated by the presence of brown clay. This was a midway phase during the formation of the glacier.

During the period of continued vegetal growth a minor climatic oscillation occurred when, in the Upper Lynn Series, a slight re-advance and subsequent retreat of a lobe of the adjacent glacier, entrenched in the mountain region, caused blue clay silt to become deposited upon the bed of the first growth vegetation. This is evidenced by the alignment of fallen trees and shrubs in a southerly direction. Vegetal growth resumed, by reafforestation from untouched localities, when this minor form of glaciation was eliminated from the immediate area.

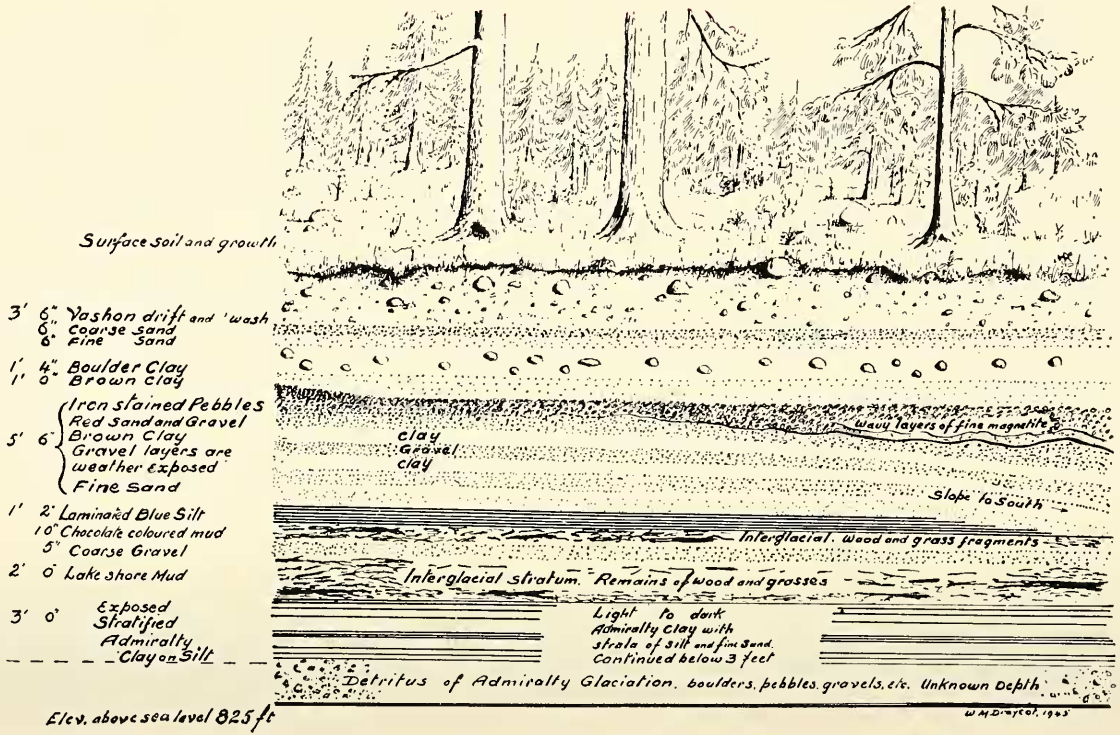
The exposures of Pleistocene deposits in the mountain region of the Lynn river exhibit a series that form a reliable basis for comparison in other sections of southern B. C., which are, in the main, composed of drift material. An isolated deposit at Point Grey being an exception.

Only after thousands of years had passed by, necessary to reduce the bulk of the great ice sheet, did local climatic conditions change to a temperature conducive to the production of a green incrustation composed of the earliest germination of some minute moss and lichen in favored areas. As the mosses and grasses decayed their mould accumulated to form a soil for the reception of the like and diminutive plants. Ferns, herbaceous plants, shrubs and trees followed in sequence. Bogs, swamp and marsh lands prevailed long before the advent of tree growth.

Pondering over the existence of a forest-marsh growth the thought occurred to the writer that Nature, in her scheme of living things, had included other forms of life in conjunction with vegetation. With such a variety of plants, bushes and trees there must be insects of some kind to pollinate and perform other functions; for not all pollination is done by winds.

Fossil Insects: Small wavy grooves and frass accumulations appearing on the surface of the wood under the bark of spruce and poplar logs and branches, first drew attention of the writer to the past existence of beetles in the Interglacial vegetal remains. The effect was there, but to find the cause! Only beetle *elytra* of the Order Coleoptera was anticipated.

Examination of samples taken from various sections of the vegetal remains resulted in finding several specimens of the brilliant-hued *Donacia* and, later, other specimens. As expert au-



CROSS SECTION of MOUND, LYNN MOUNTAIN REGION B.C.
PLEISTOCENE DEPOSITS

thority was a factor in distinguishing the specimens they were despatched to the State University of California, to be later transferred to a prominent expert in entomology, Dr. W. Dwight Pierce of the Los Angeles County Museum, who is now proceeding with their classification.

Nature of the Interglacial Flora: The thickest deposit of Interglacial vegetal matter occurs in Lynn Valley Park, composed mainly of drift material. Prior to the disastrous landslide of November 14, 1919 the thickness was 12 feet and occupied several acres. Its extent is now measured in feet!

A heavy burden of Vashon (last ice epoch) detritus has pressed the vegetal material into laminated compactness. In the year 1916 the black to brown-black matrix attracted the attention of two prospectors. They excavated a tunnel 100 feet into the mass in the hope of finding coal! There is now no vestige of either tunnel or material; a cloudburst and landslide swept the area clean.

Logs and branches of trees in the matrix have a somewhat flattened appearance. This peculiarity can be readily understood when considering the weight of the massive bulk of glacial till, immense boulders of the Vashon glaciation and, additional, for a great length of time, the overburden of a glacier which for each 1,000 vertical feet there was 50,000 pounds of pressure to the square foot (Prof. Dana).

Species of *Populus* formed the major tree growth; others, in order of succession, as found, are cedar, willow, alder, spruce, birch, and a species of yew. Among the bush plants the blueberry (*Vaccinium*) and hardhack (*Spiræa*) held sway. Among sedges and grasses, in the matrix, the age-old *Equisetum* (Horse-tail) occurs. Considerable of the twigs and small tree branches have become lignified. Taken collectively this assemblage of plant life suggests a climate similar to that now obtaining in this coastal area of British Columbia.

Pleistocene Forest-Bush Fires: In three localities of the North Burrard area where Interglacial vegetal matter is exposed there is evidence of conflagration having spread over an extensive tract. Charred members of tree limbs and well-burned logs imbedded in black hardened mud compose a lower stratum of the shaly vegetal deposit. Angular-shaped rock fragments underlying the burned material are the result of great heat, thus altering the feldspars of the granite to render the fragments friable.

As to the origin of the fire there are two possibilities. If not through the agency of lightning then the cause can be attributed to volcanic ejectamenta from the now extinct Garibaldi volcano

a few miles to the north. The occurrence of volcanic ash and cinders in the Pleistocene deposits, in places intermingled with the vegetation, suggests that origin.

With much of the area being swamp or marsh land the plant growth did not suffer total extinction, as evidenced by subsequent production. The great Interglacial Period, as distinguished from lesser interglacial phases, is the time assigned to the growth of this vegetation, whose scant remnants are exposed in places along the banks of the Lynn Seymour and Thames and Hastings streams. The deposits are overlain by varying thicknesses of Vashon glaciation drift and outwash.

INTERGLACIAL VEGETAL DEPOSITS FROM CORDOVA BAY, VANCOUVER IS., B. C.

About 70 miles west of North Burrard (Inlet) another exposure of Interglacial vegetal deposits occurs at the south end of Cordova Bay, near Victoria, Vancouver Island.

Desiring to correlate these deposits with the Upper Lynn Series a visit was made by the writer, accompanied by the Ven. Archdeacon R. Connell of Victoria, in September, 1945. The vegetal deposit at Cordova Bay is exposed a few feet above high-water mark at the base of a cliff, 200 feet high, and although the formation appears to be *in situ* it is suggested its present position is the result of an almost vertical drop-down instead of a slide toward the beach, resulting from marine erosion.

The cliff face is exposed sufficiently to show a series of stratified sand gravel and clay overlying the vegetal deposit. About 200 yards southward is the lava-rock barrier of Cormorant Point, that forms the southern extremity of Cordova Bay. This barrier (to ice movement) once formed the southern margin of an Interglacial lake or swamp.

Judging from the general aspect of this vegetal deposit, with seams varying in thickness from 4 inches to 40 inches, the local vegetation received an additional amount of detritus, in the form of drift, from a locality immediately northward, through the agency of Vashon glaciation. Crushing and folding are in evidence throughout the whole mass of this superficial material, resulting from resistance at the barrier and pressure from the north.

Indurated silt-clay immediately overlying the vegetal deposit contains moderately scattered fragments of twigs, leaves and grasses; suggestive of lake-shore material washed in contemporaneously with the debris from the north, or soon after. No logs or stumps of trees have, as yet, been found in the matrix seams,

though a small piece of the branch of a cedar tree was picked out by the writer. The vegetal matter is a brown-black to black mass composed of swamp growth with fragments of small trees, shrubs, plants, sedges and grasses. When sun-dried the matrix assumes the near hardness of lignite. By immersion in water for a reasonable time the laminated peaty substance separates. Between the thin layers imprints of plants are discerned.

Beetle Elytra: Several *elytra* of a metallic-green beetle were conspicuous among the peaty layers of the vegetal matrix when split apart. These, and other, insects are identical to the ones occurring in the Upper and Lower Lynn Series and the Scarborough Cliff Series of the Interglacial Period in Ontario, Eastern Canada.

Geological Comparisons: Although a distance of 70 miles, or so, separates the Vancouver Island deposits from those of the mainland there is but little difference in the stratigraphy and composition. Cordova Bay is similar to Point Grey shoreline exposures and both are situated at about the same land contour; they both face the Strait of Georgia. But whereas the Point Grey formation received its sediments from the Fraser Valley glacial route, in the main, Cordova Bay material was transported from the north, and contains considerable fragments of Coast Range rock.

The land being depressed during occupation by glaciers rose again on recession of the ice. At the time of Admiralty ice melt the areas specified in this report, as containing vegetal matter, were considerably below water level to permit silt deposits. Land uplift occurring soon after the retreat of the Vashon glacier elevated the Upper Lynn Series 825 feet above present sea level, while the Cordova Bay vegetal deposits record only a few feet. The mountain regions rose higher than the lowlands.

Under the black vegetal deposit at Cordova Bay there is a seam of indurated clay; it contains an occasional angular pebble of Coast Range origin and strata of fine sand, generally intercalated. The whole formation is underlain by stratified blue clay of Admiralty glaciation. Compared with the Upper Lynn Series these lower strata of the Cordova Bay formation are coeval. In their order of deposition the exposure at Cordova Bay show:

1. Surface soil and general level.
2. A steep slope with dense vegetation, trees, shrubs and plants, growing upon a strata of sand gravel and clays; having a vertical depth of approximately 180 feet.
3. 10 feet of indurated clay, interspersed with light vegetal remains. Folding is shown.

4. 40 inches of hard, compacted, black vegetal matter in shaly arrangement. This depth of 40 inches is the maximum thickness; the minimum being about 4 inches. The deposit displays folding and faulting and has a dip westward of about 25 degrees.

5. 4 feet of white clay-sand, very fine, with inclusions of calcareous concretions.

6. An undetermined depth of thinly stratified blue clay of Admiralty glaciation origin. Conforming with numbers 4 and 5, above, it dips westward at about the same angle.

3. A CHERMID WING FROM INTERGLACIAL LIGNITE

By W. Dwight Pierce

While examining the interglacial lignite collected by Mr. Walter MacKay Draycot at Cordova Bay, Vancouver Island, British Columbia, the writer split a piece open and discovered a beautiful specimen of an almost perfectly preserved wing of a chermid. This specimen had one characteristic which set it off from most of the order, a cross vein between Radial sector and Media, forming a closed elongate, somewhat pentagonal discoidal cell.

In a search of the literature such a discoidal cell has been found only in 5 described genera, but in none of these was the cross vein in the same position. For this reason it is given a new generic name.

D. L. Crawford did not consider the wings alone sufficient for classifying the genera into groups, hence it is not definite to what subfamily the new genera should be assigned. However, since three genera with closed discoidal cells belong to the Cherminæ, it has been so assigned.

Only two fossil Psylloptera have been described from North America, *Necropsylla rigida* Scudder, based on 4 specimens, two of which are figured; and *Catopsylla prima* Scudder, both from Florissant, Colorado, shales (Scudder 1890. Tertiary Insects of North America).

If one can judge at all from the drawings, the two specimens of *Necropsylla rigida* do not belong to the ame species, although they apparently have in common a cross vein between Media 3+4 and Cubitus 1. No. 310 also has a cross vein from Radial sector

to Media 1+2 beyond the forking of Media, and this is absent in No. 349. The Scudder types should be reëxamined, and if the drawings are correct one specimen should receive a new name.

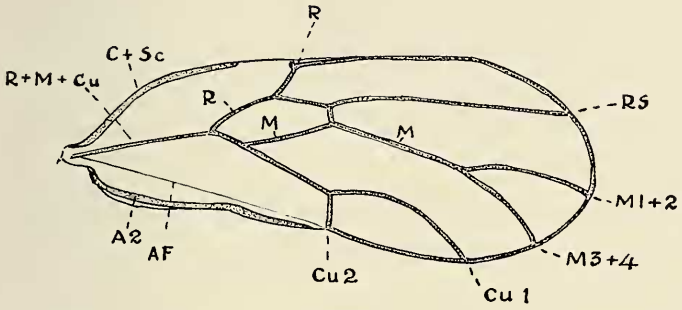


PLATE 9

Wing of *Draycotia cordovæ*. Pierce
Enlarged approximately X 30
Drawing by the author

A cross vein from Media to Cubitus is very rare although F. W. Pettey found it to occur as a variant in specimens of *Arytaina acaciæ-baileyanæ* (Froggatt).

Order Psylloptera Kraus & Wolff 1919.
Family Chermidæ Kirkaldy 1904.
Subfamily Cherminæ VanDuzee 1916.
Genus Draycotia, new genus.
Type-*Draycotia cordovæ* new species (Plate 9).

The genus and species are described from a single wing (1945-269. CB-3), found on splitting a piece of interglacial lignite from Cordova Bay, Vancouver Island, British Columbia, collected by Walter MacKay Draycot, in whose honor the genus is named. The type is deposited in the Los Angeles County Museum.

Wing elongate, measuring 2.04 mm., narrower at apex of anal fold (0.07 mm.) than at apical fourth (0.84 mm.), apically rounded. The heavy Costa-Subcosta vein is marginal, not reaching the pterostigma. The Radio-media-cubital stem is more than one-fourth the length of the wing. It branches into Radial and Media-cubital stems. The Radial stem branches into Radius 1 and Radial sector, and is considerably longer than the Media-cubital stem. Radius 1 has a short spur to the margin, and with

it forms a narrow clear pterostigma, beyond which the Radius becomes marginal, extending around the periphery of the wing to the Anal fold. From Radial sector there is a cross vein to Media, which thus forms the one discoidal cell, irregularly elongate pentagonal in form. Media-cubital stem divides into Media and Cubitus, and each of these divides again, forming Media 1+2, Media 3+4, Cubitus 1, and Cubitus 2, the last almost vertical to the margin. The anal or vannal fold faintly extends from base of the wing to the end of Cubitus 2. One Anal vein (Anal 2) is present, but not marginal in all of its course; it reaches almost to the Anal fold.

The drawing is made from a photograph, and is correct in all proportions.

The genus can be separated from others having a discoidal cell by the following key:

Key to genera with closed discoidal cell formed by a cross-vein from radial sector to media, or by contact of these two veins.

1a. Media and Radial sector in contact at point of forking of media. Brazil) ..... Epicarsa Crawford

b. Media and Radial sector united by a cross vein 2

2a. Cross vein reaching Media a considerable distance before its forking (British Columbia fossil)—Draycotia Pierce.

b. Cross vein reaching Media at or beyond the forking 3

3a. Cross vein reaching Media at its forking. (Tahiti)
..... Mesohomotoma Kuwayama
..... Tenaphalara Kuwayama

b. Cross vein reaching Media 1+2 beyond forking 4

4a. No cross vein between Media 3+4 and Cubitus 1. (Africa, South and Central America) ..... Ceriocremum Enderlein
..... Phacopteron Buckton

b. Cross vein from Media 3+4 to Cubitus 1. (Colorado Florissant) ..... Necropsylla Scudder